



Epidemiological and clinical characteristics of scorpionism in Colima, Mexico (2000–2001)

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Abstract

We analyzed 13,223 clinical records of patients treated for scorpion sting in hospitals of the Mexican Institute of Public Health and the Ministry of Health in the state of Colima, Mexico, during the years 2000–2001. A database containing demographic, epidemiological and clinical information was constructed and analyzed retrospectively. Patients were classified in the categories as mild (49.2%), moderate (33.8%) and severe (17.0%) according to commonly accepted standards. Most common symptoms recorded were local pain (94.7%), local paresthesia (67.2%), pruritus/itching (54.3%), sensation of a lump or hair in the throat (47.3%), and sialorrhoea (27.7%). The median time from sting to admission to the emergency room (patient delay) was 33 min (interquartile range: 12–60). We found that older and clinically severe patients were significantly associated with longer times of admission to the emergency room. Age was significantly associated with clinical severity: the age group 0–10 years included a higher proportion of severe cases than the group 11 years and older. In four cases, patients died. An educational campaign to inform the population about the importance of receiving prompt attention following a scorpion sting has potential value in reducing complications in the emergency room.

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1. Introduction

Scorpionism is a public health problem in several regions of Mexico (Hoffmann, 1936; Calderon-Aranda et al., 1996). In fact, the highest mortality rate of up to 1944 deaths has been reported in Mexico in 1946 (Mazzoti and Bravo-Becherelle, 1963).

Around the world, almost 1500 scorpion species have been reported but only about 25 species are dangerous to

humans (De Roodt et al., 2003). In Mexico, approximately 170 species of scorpions have been identified (Fet et al., 2000; Beutelspacher, 2000) but only those of the genus *Centruroides* (family Buthidae) are highly venomous (Hoffmann and Nieto, 1939), possess mammal-specific toxins, and therefore are dangerous to humans. There are a number of reports of the clinical and epidemiological characteristics of *Centruroides* scorpion stings in humans including *C. suffusus* (Gonzalez Romero et al., 1991) and *C. infamatus* (Dehesa-Davila, 1989). However, the literature on the epidemiological and clinical characteristics of scorpionism in the hyper-endemic area of the state of Colima (Mexico) is scarce. The exception is the recent work

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of Diaz et al. (2005) on the pediatric cardiovascular alterations following *Centruroides limpidus tecomanus* scorpion envenomation in the state of Colima, Mexico.

Only two species of highly venomous *Centruroides* have been so far recorded from Colima (Mexico): *Centruroides infamatus* and *C. limpidus tecomanus* (Fet et al., 2000; Beutelspacher, 2000). In this retrospective study, we report on the epidemiological and clinical aspects of 13,223 scorpion stings in humans in the state of Colima, Mexico.

2. Patients and methods

A retrospective study was conducted during the period 2000–2001 in the hospitals of the Health Ministry (SSA) and the hospitals of the Mexican Institute of Public Health (IMSS), which provide service to 95% of the population in the state of Colima, Mexico. The state of Colima is located on the Pacific coast, has a tropical climate, and a population of 488,028 inhabitants, according to the latest census data (INEGI, 2000).

2.1. Treatment in SSA and IMSS hospitals

Centruroides polyvalent antivenom is used in SSA and IMSS hospitals. This antivenom is enzymatically digested and lyophilized. One ampoule neutralizes 150 LD₅₀ in mice tested intraperitoneally (Dehesa-Davila and Possani, 1994). The antivenom used at SSA hospitals is produced by the Health Ministry (Dehesa-Davila and Possani, 1994) while the antivenom used at IMSS hospitals is produced by the BIOCLON institute (<http://www.bioclon.com.mx>). To reduce the risk of antivenom reactions, hydrocortisone and diphenhydramine (antihistamine) are sometimes administered in SSA hospitals but not in IMSS hospitals. Moreover, in IMSS hospitals service is provided by medical doctors with significant experience, while in SSA hospitals treatment of patients stung by a scorpion is often provided by social service medical students.

2.2. Use of antivenom

For children less than 5 years old, two ampoules of antivenom are administered because of the higher venom concentration in their bodies. For the patients older than 5 years, antivenom is administered according to their clinical picture. One or two ampoules are administered to neutralize the circulating venom in moderate and severe cases; in mild cases, antivenom is not recommended. Up to five vials of antivenom are administered when no improvement in the clinical picture is observed after 15–20 min of its administration or when the patient comes to the hospital in later stages of envenomation.

2.3. Patient classification by severity of symptoms

Patients were assigned to one of three clinical states (mild, moderate and severe) based on a clinical evaluation and according to commonly accepted standards (Velasco-Castrejon et al., 1976; Osnaya-Romero et al., 2001; Meki et al., 2003):

- Mild*. Patients with symptoms limited to localized pain and/or paresthesia.
- Moderate*. Any of the previous symptoms, plus any of the following: nasal and/or pharyngeal pruritus/itching, sialorrhoea, restlessness, and general paresthesia.
- Severe*. Any of the previous symptoms, plus any of the following: sensation of having a lump or hair in the throat, vomiting, blurry vision, temporary blindness, nystagmus, dysarthria, muscle ataxia, abdominal distension, opisthotonos, convulsions, and priapism.

2.4. Clinical record

The data recorded in the present study included the institution where the patient was treated (SSA or IMSS), the municipality where the accident took place (Fig. 1), the date and time of the accident, occasion (home, agricultural activity, school, etc.), part of the body affected, age and sex of the patient, symptoms, complications, patient delay (time that elapsed from the sting to the admission to the emergency room), amount of antivenom administered, and the number of previous scorpion stings.

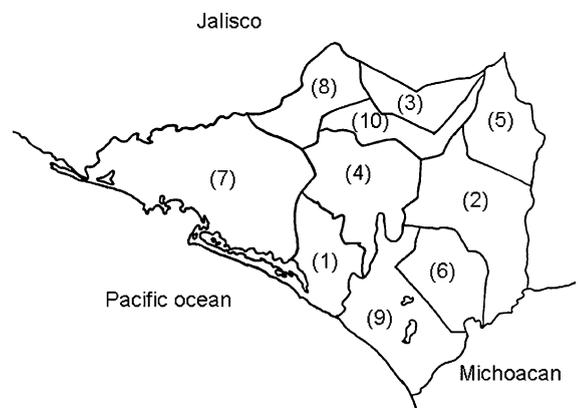


Fig. 1. Map of the state of Colima, Mexico with its municipalities. Most of the cases of scorpion sting occurred in the municipalities of Manzanillo (7) (33.1%), Tecomán (9) (24.4%), and Armería (1) (12%) followed by Cuauhtemoc (5) (6.6%), Comala (3) (6.5%), Coquimatlán (4) (6%), Colima (2) (4.7%), Minatitlán (8) (3.6%), Villa de Alvarez (10) (1.8%), and Ixtlahuacán (6) (1.3%).

2.5. Statistics

We express our results as the mean \pm standard deviation (SD) of the data. Proportions were compared using Fisher's exact test (Agresti, 1996). Results were deemed significant when the *P*-value was less than 0.05.

3. Results

All of the 13,223 cases of scorpion stings reported in the hospitals were included in the present study. The number of cases treated in hospitals of the Health Ministry (SSA) was 8327 (63%), and 4896 (37%) cases were treated in hospitals of the Mexican Institute of Public Health (IMSS).

Male/female ratio of patients was 1.2:1 (7263 males, or 55%, and 5942 females, or 45%). The gender was not recorded in 18 cases. The average age of males was 27.15 ± 19.01 (SD) with a mode of 20 years. For females, the average age was 27.53 ± 18.54 with a mode of 16 years. Children younger than 5 years constituted 803 cases, and in 123 cases patients were older than 80 years. Most of the scorpion stings affected hands/arms (64.2%) followed by stings in legs (25.3%), thorax (7.4%), head (1.9%), and neck (1.2%).

We found that the total number of scorpion stings during the study period in the Colima municipalities increases

linearly with the municipality population size except for the municipalities of Colima and Villa de Alvarez, which observe a relatively low number of scorpion stings despite their high population density. This can be explained by the higher urbanization levels of these two municipalities than in the rest of the territory, leading to a reduction in the number of suitable environments for scorpion subsistence.

The daily number of scorpion stings in the studied region shows a seasonality pattern with higher incidence during the months of June–October (Fig. 2). Also, the peaks of the incidence curves correlate well with rainfall in 2000 and 2001. This increase probably occurs because the precipitation inundates the burrows where scorpions live, forcing them to look for new refuges. The higher incidence in the months of June–October is also explained by the increase in agricultural activities in rural regions. A detailed analysis on the association of climatological variables and scorpion sting incidence in Colima, Mexico has been reported elsewhere (Chowell et al., 2005). The highest frequency of scorpion stings occurs inside houses [10073 cases (76.2%)] followed by agricultural activities [2243 cases (17%)], and occurs with about the same frequency in streets, schools, and offices. The median time from sting to admission to the emergency room (patient delay, PD) was 33 min (interquartile range: 12–60). Most of the individuals took a considerably small amount of time to be admitted to the emergency room [6392 (48.3%) cases with PD < 30 min]

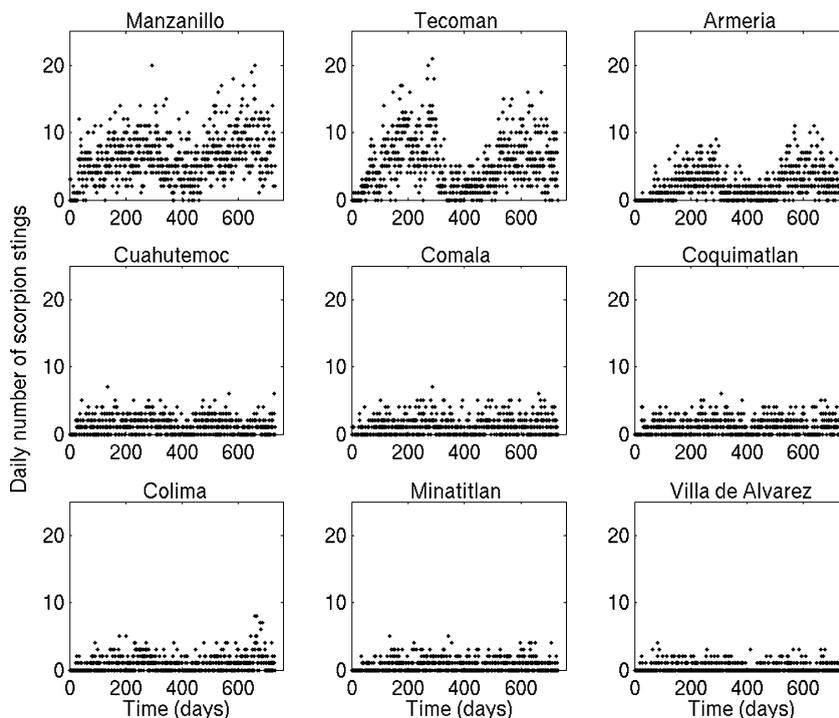


Fig. 2. The daily incidence of scorpion stings during the period of study (2000–2001) in 9 of the 10 municipalities of the state of Colima, Mexico. The seasonality pattern can be explained by the higher activity of scorpions during the months of June–October when the temperatures are higher and the rainy season takes place.

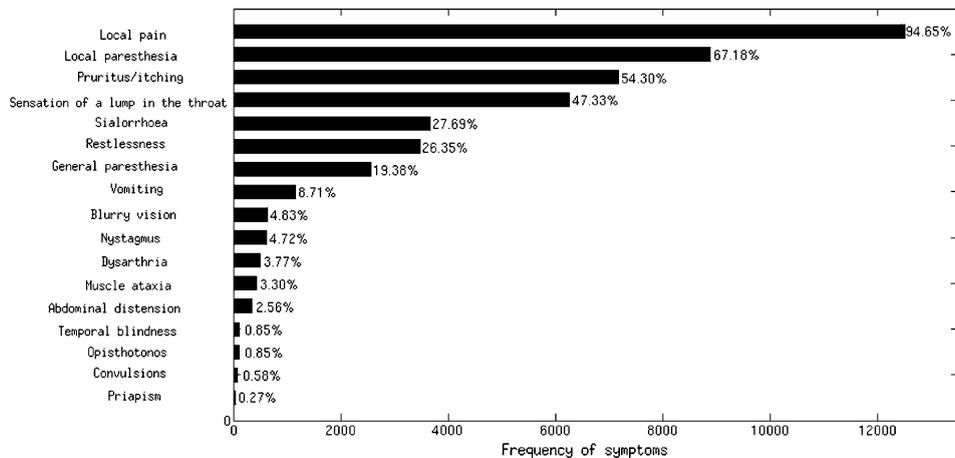


Fig. 3. Relative frequency of symptoms developed by patients stung by a scorpion.

while the patient delay of relatively few individuals was very large [329 (2.5%) cases with PD > 300 min]. We found a significant association between patient delay (PD) (time elapsed from scorpion sting to admission to emergency room) and clinical severity (36.6% severe cases with PD < 30 min and 49.1% severe cases with PD > 30 min; P -value < 0.001; Fisher's exact test). Furthermore, the proportion of males with a patient delay greater than 30 min was significantly higher than for females (57.3 vs. 52.3%; P -value < 0.001).

Moreover, 9080 (68.7%) cases had experienced a scorpion sting previously, while 1422 (10.8%) cases reported having experienced more than six scorpion stings in their lifetime.

The relative frequency of symptoms presented is shown in Fig. 3. The most common symptoms presented included local pain (94.7%), local paresthesia (67.2%), pruritus/itching (54.3%), sensation of a lump or hair in the throat (47.3%), sialorrhoea (27.7%), and restlessness (26.4%) while temporary blindness (0.85%), opisthotonos (0.85%), convulsions (0.58%), and priapism (0.27%) were rarely present.

Cases were classified as mild (49.2%), moderate (33.8%), and severe (17%). We found a significant association between clinical severity and age, whereby the 0–10 years age group presented higher proportion of cases in clinical severity when compared with those from 11 years and older (28.4 vs. 14.7%, P -value < 0.001; Fisher's exact test). In SSA hospitals, hydrocortisone was administered to 6109 (46.2%) cases while diphenhydramine was administered to 3868 (29.3%) cases. Both hydrocortisone and diphenhydramine were administered to 1933 (14.6%) cases. We did not find a significant association between the number of severe cases and the treatment provided by SSA and IMSS hospitals (P -value = 0.27; Fisher's exact test). For those individuals treated in SSA hospitals, we found a significant

association between the presence of clinical severity and gender, whereby males presented higher proportion of cases in clinical severity than females (18.6 vs. 15.5%, P -value < 0.01; Fisher's exact test). However, we did not find that association in cases treated in IMSS hospitals (P -value = 0.09; Fisher's exact test). Four deaths, due to pulmonary edema followed by heart failure, were recorded giving a mortality rate of 3 deaths per 10,000 scorpion stings. Three of the cases that resulted in death were treated in SSA hospitals but we did not find a significant association between death and the different treatments provided by the SSA and IMSS hospitals, or between death and gender. Two of the cases that resulted in death were admitted to the hospital in later stages of envenomation (420 and 150 min); in one case, the person was stung at home and the other was stung while engaged in agricultural activities.

4. Discussion

There are a number of reports on the clinical and epidemiological aspects of scorpionism in Mexico (Hoffmann, 1936; Velasco-Castrejon et al., 1976; Dehesa-Davila, 1989; Lagunas Flores and Villegas Arrison, 1989; Gonzalez Romero et al., 1991; Aldana-Gonzalez and Aldana-Gonzalez, 1992; Dehesa-Davila and Possani, 1994; Calderon-Aranda et al., 1996; Zarate-Aguilar and Maraboto-Martinez, 1997; Hernandez Lomeli et al., 1994; Diaz et al., 2005). Here, we carried out the first extensive study of 13,223 scorpion stings that occurred over the 2-year period 2000–2001 in the state of Colima, Mexico where the venomous scorpion species *C. infamatus* and *C. limpidus tecomanus* are found. All the cases were treated in hospitals of the Health Ministry (SSA) and the Mexican Institute of Public Health (IMSS). The higher incidence during the summer months was well

correlated with the rainy season, an observation that has also been made by Mazzoti and Bravo-Becherelle (1963). On the contrary, Dehesa-Davila (1989) associated the beginning of the rainy season with a decrease in the number of scorpion stings, while a higher incidence was recorded in the spring. De Roodt et al. (2003) also recorded the higher incidence of stings by *Tityus trivittatus* during the warmer months in Argentina (October–April). While we did not observe high frequency of vomiting for *Centruroides* stings (8.71% of all cases in Colima), Freire et al. (1994) (*Tityus serrulatus*) and De Roodt et al. (2003) (*T. trivittatus*) have observed higher frequencies (>90 and 25%, respectively). This could be probably due to differences in toxicity of the scorpion species. Most of the Colima cases were classified as mild (49.2%) in good agreement with the findings of Dehesa-Davila (1989) who reported 47% of cases with local manifestations after analyzing 38,068 scorpion stings by *Centruroides infamatus infamatus*. Mazzei de Davila et al. (1997) reported 42.2% of the cases with local manifestations in 64 children stung by *Tityus zulianus* in Merida, Venezuela.

In agreement with De Roodt et al. (2003), we found a significant association between clinical severity and age, whereby the 0–10 years age group presented higher proportion of cases with clinical severity when compared with those from 11 years and older. We found no association between the treatment received by the patients in SSA and IMSS hospitals and presence of clinical severity. This places under doubt the efficacy of the use of dyfenhidramine and hydrocortisone for the treatment of *Centruroides* stings (Russell and Minoo, 1984). The association between clinical severity and gender revealed in SSA hospitals is interesting, and more work will be required to determine the factors that could be playing a role in this association. The same association was not statistically significant in IMSS hospitals.

We found that the distribution of patient delay (time from scorpion sting to the emergency room) is well skewed to the right. This could be due to difficulties for some individuals to go to the hospital or simply to the lack of information about the importance of receiving treatment as quickly as possible. In fact, we found a statistically significant association between patient delay and clinical severity (P -value < 0.001; Fisher's exact test). Hence, an educational campaign to inform the population about the importance of receiving prompt attention following a scorpion sting is potentially valuable in reducing complications in the emergency room.

The mortality rate reported here (3 deaths per 10,000 scorpion stings, i.e. 0.03%) is smaller than that of 0.59% reported by De Roodt et al. (2003) (*T. trivittatus*) and 0.28% reported by Freire et al. (1994) (*T. serrulatus*). We did not find any statistically significant association between death and treatment (in SSA or IMSS hospitals). To the best of our knowledge, this is the first study aiming at understanding the

epidemiological and clinical aspects of scorpionism in the state of Colima, Mexico.

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